From Electromagnetics and Signal Processing:
A Software Based Approach for Radome Characterization

Tamer Ibrahim[1], Mark Yeary[1], and Cengiz Altan[2]
[1]School of Electrical & Computer Engineering
[2]School of Mechanical & Aerospace Engineering
University of Oklahoma
Norman, OK 73019   Tel: 405-325-8131

Background: Our goal is to develop a software tool that assists in making radome characterization improvements, i.e. 1) extract new information (see defects that are not seen in existing approaches) and 2) improve existing information (increase the spatial resolution).   Currently, the specific way of interpreting radome-radar testing data is through a Technical Order (TO) that instructs the operators to pass through a select number of cuts at a select radome azimuth and elevation (relative to the transmitting and receiving antennas, which are bore sighted on each other) and then the received data that is passed through the radome is processed.   Data processing is then performed to determine the difference between what's received and what's acceptable at a given radome azimuth and elevation, which leads to calling the radome either "passing" or "failing."   This technique results in very coarse resolution radome characterization leading in-effective evaluation and consequentially in-effective repair of radome failure.

Approach: Designing a software based image processing tool for radome characterization depends on the knowledge and understanding of three specific fields, signal processing, electromagnetics (EM), and materials.   In our interdisciplinary approach to this project, we will incorporate these three aspects to achieve a software tool that is robust (can potentially be implemented on many types of radomes, efficient (does not require significant run time), reliable (rarely provide false results), accurate (in predicting position and type of defects), and easily transportable. For characterizing and providing locations of radome defects, our main goal will be to utilize sophisticated 3-dimensional signal processing tools which will provide means (3-D radome visualization tool) for the engineers to identify the locations of the defects at a much better efficiency compared to the current manual tests which are time consuming and therefore costly. Determining the electromagnetic characteristics of these defects, and therefore their effects on the radar obtained data is also another goal of this project. In this project, we will begin investigating a knowledge system based on simulations where we will investigate the possibility of using 3-D computational electromagnetics and neural networks in performing electromagnetic simulations involving the radome geometry and transmit and receive antennas.

Benefits: The outcomes of this project will enable the Government to potentially improve the radome characterization process across The United States by shortening test time and simplifying radome test procedures. This in turn means that cost and risks will be reduced while test quality will also increase because of the expected enhancement of that the proposed software tool will provide.